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Regulating Electricity Distribution Networks to Facilitate the Efficient Deployment of Smart Grid Technologies

Presentation to the EURELECTRIC Workshop on Infrastructure Investment and Smart Grids in South East Europe

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Overview

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- Defining a smart grid, and why it is important to support / encourage their use in regulating distribution networks
- A traditional model of regulation, and why it does not encourage the use of “smart” measures.
- Enhancements to traditional regulatory models that begin to encourage the economically efficient deployment of smart grid technologies
- Conclusions

What are “smart grid” measures?

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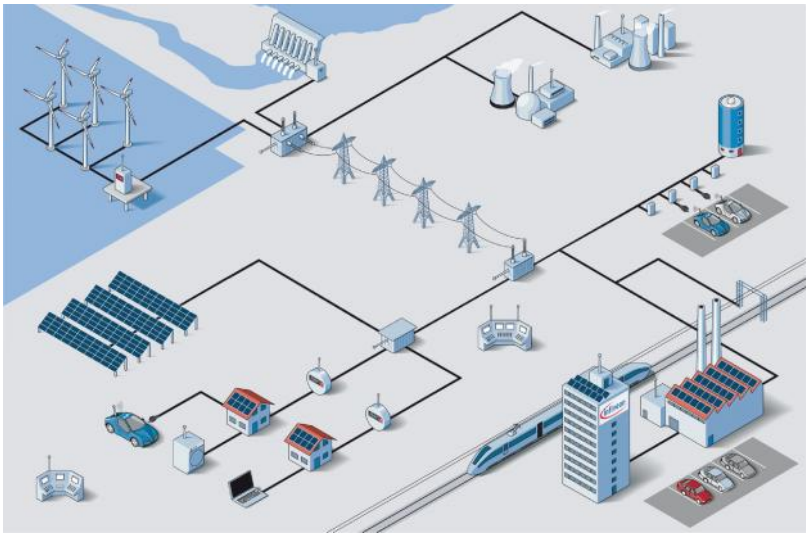

Source: http://www.presseagentur.com/

2

When is it efficient to use “smart grid” measures?

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From the perspective of the distributor “smart” technologies reduce or defer traditional network investments, which reduces total cost in some situations

- Substituting capital intensive solutions for operating measures:
  - Smart measures like storage, demand side response, or active network control can provide a service to the network that substitutes for conventional asset-heavy solutions at a lower cost
  - Requires flexible and sometimes innovative planning practices

Evaluation of Trade-off Between Traditional and Innovative Solutions

Traditional: High capex solution

vs.

Innovative Solutions: Economising on capex using operating measures

3

When is it efficient to use "smart grid" measures?

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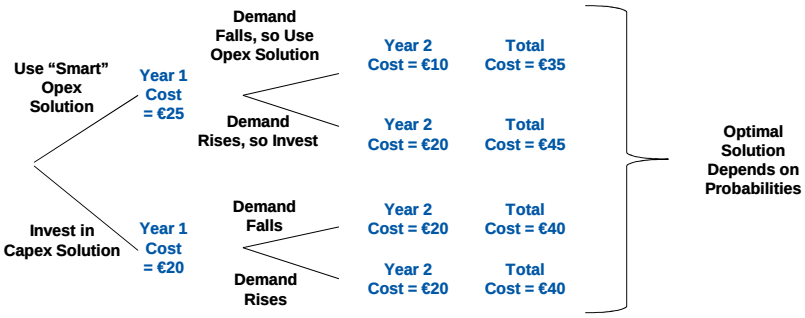
From the perspective of the distributor "smart" technologies reduce or defer traditional network investments, which reduces total cost in some situations

- Reducing risk of stranded assets through the **option value** of "smart" measures
  - Using a relatively expensive operating solution today can still be preferable to a capex solution if it provides a value from waiting for uncertainty about the future to resolve



From a DSO's perspective, what is needed to deliver smart measures efficiently and how can regulation help?

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Innovative thinking from the company + Some enabling investments, like IT infrastructure + Corporate processes for trading-off the pros/cons of opex and capex solutions + Commercial mechanisms for buying "smart" services from network users = Efficient use of "smart" measures

A regulatory regime that rewards innovation and economically efficient behaviour will encourage this

Prudence criteria (where applied) need to recognise the potential value of anticipatory investments.

Incentives to efficiently trade off short-term opex and long-term capex

Cost-reflective network pricing, procurement mechanisms for non-network technologies, smart metering.

Requires anticipated rates of returns commensurate with the risks of particular investments

The incentives imposed on DSOs through tariff regulation determines whether these conditions for the efficient use smart grid technologies are satisfied

A notional framework for setting tariffs using a cost of service approach

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$Revenue_t$ = Actual or Budgeted Operating $Costs_t$
+ Depreciation of RAB_t
+ Estimated WACC x RAB_t

Regulatory Asset Base $(RAB)_t = RAB_{t-1}$ + Actual $Capex_t$ – $Depreciation_t$

- Revenues are closely linked to costs, so companies may see short-term benefits from reductions in opex, but generally do not benefit from longer-term operational cost savings or capex reduction
- Some jurisdictions use an approval process for capex projects on a case-by-case basis, sometimes linked to defined prudence rules

6

Will this framework deliver an efficient use of smart grid measures?

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Aspects that are supportive of smart measures

✓ Low risk environment may be necessary for attracting capital, particularly in emerging markets, which is important for both "smart" and traditional investments

✓ Some models may convey modest incentives to beating the regulator's annual opex forecasts

Aspects that may prevent the efficient uptake of smart measures

X Weak incentives to minimise cost leads to low incentive to innovate or adopt new working practices

- X Planning standards and prudency criteria are somewhat mechanical and often outdated

X Potentially strong capex biases:

- X Little incentive to make efficient trade-offs between opex and capex, especially where capex allowances are set using cost-plus mechanisms and opex allowances are fixed for short periods
- X Sometimes allowed returns exceed market cost of capital

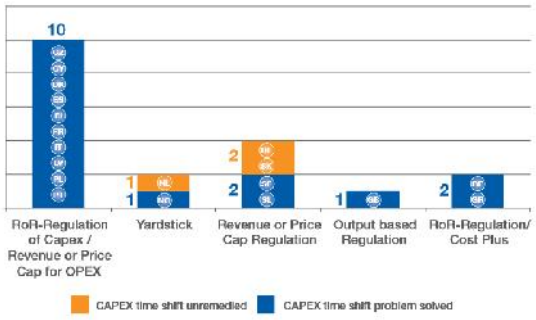
7

European regulatory models do not tend to encourage smart grid deployment

- Many EU jurisdictions still adopt regulatory methods that suffer from these shortcomings
- Most DSO's surveyed by Eurelectric say their regulatory frameworks do not support smart grid investments

Source: Electricity Distribution Investments: What Regulatory Framework Do We Need?, Eurelectric, 2014.

Types of Regulatory Regimes Used Across 19 EU Member States



Does the Regulatory Regime Support Innovation?

8

Options for developing regulatory frameworks to encourage economically efficient use of smart technologies

Broader use of incentive-based regulation

- Fixed term price controls to strengthen efficiency incentives, with allowed tariffs linked to forecasts of, not actual, expenditure
- Incentive mechanisms linked to quality of service targets

Encourages cost reduction, including potentially through smart measures

- But, many models of incentive regulation have capex biases
- There tends to be a strong focus on opex reduction, and little incentive to innovate
- Solutions (eg. UK, Italy): adopt totex mechanisms to equalise opex and capex incentives

Institutional challenges for Implementation in South East Europe

- Prevalence of state ownership mutes incentives for efficiency
- Requires strong, independent regulatory institutions to protect DSO investor returns

9

Options for developing regulatory frameworks to encourage economically efficient use of smart technologies

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Prudence (capex approval) criteria that oblige companies to consider smart alternatives

- Some jurisdictions in SEE use cost-plus regulation for capex, which could be easily supplemented with enhanced criteria for investment approval

Obliges companies to consider the alternatives to conventional solutions

- This could work, for instance, by obliging DSOs to tender for non-network alternatives to proposed network reinforcements (above a certain threshold)
- Australia's Regulatory Investment Test for Distribution is an example of this mechanism
- This could be combined with reform of planning standards to define processes for assessing the value of smart alternatives, and possibly defining what smart measures should be used in what circumstances

Potential savings have to be offset against extra administrative costs

- Tenders for non-network solutions might be administratively complex
- New obligations to use cost benefit analysis to select smart investments might impose cost on DSOs

10

Options for developing regulatory frameworks to encourage economically efficient use of smart technologies

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Explicit incentive payments for adopting smart measures

- For instance, some jurisdictions offer WACC premia for investments in smart grid measures. (Some US states offer premia on the Cost of Equity.)

Simple, targeted measure to promote smart grids

- Gives companies a defined objective to achieve increased deployment of smart technologies
- Can be used to offset the capex biases that would tend to lead companies to use more conventional alternatives

Blunt instrument; may distort other incentives

- A big downside is that this is a crude instrument, which requires calibration based on the assumed benefit of smart grid measures
- These benefits are hard for regulators to observe and even harder to codify, as they are highly variable

11

Options for developing regulatory frameworks to encourage economically efficient use of smart technologies

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More efficient pricing of energy and network access

- Move to more cost reflective network charges to better signal the cost that users impose on (benefit users create for) the DSO
- Introduce differentiation by location and maybe customer type
- Nodal, real time tariffs is the desirable (though potentially infeasible) target

Encourages efficient behaviour by potential providers of smart solutions

- More efficient tariff structures support the efficient deployment (location and amount) of embedded generation, storage and demand response by third parties
- Important for getting the most out of smart meters

Some more "advanced" time of use tariffs may be complex and require smart meters

- Some enhancements to tariff design are relatively straightforward (more cost-reflective balance between per kW/kWh charges)
- Whilst efficient, some tariff models raise concerns over equity (consumer protection, etc) for smaller customers

12

Options for developing regulatory frameworks to encourage economically efficient use of smart technologies

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Funding for innovation programmes

- One barrier to smart measures is the lack of innovation in network technologies
- Most regulatory models provide no incentive to undertake R&D funding

Simple, targeted measure to promote smart grids

- Can accelerate deployment of smart measures, as well as enhance knowledge and understanding

Funding constraints may be prohibitive

- Funding constraints may be prohibitive in some SEE jurisdictions.
- Some jurisdictions may prefer to adopt a "fast follower" model, drawing on research conducted in other jurisdictions (see major research programmes in UK and Germany, for instance)

13

Conclusions on the regulation required to achieve efficient smart grid measures in SEE

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- In jurisdictions with cost-plus regulatory arrangements, new investment approval processes may be needed to:
  - Recognise anticipatory investments, possibly combined with higher rates of return, commensurate with the risks associated with these assets; and
  - Incorporate non-network solutions to encourage or oblige DSOs to trade-off "smart" and traditional solutions.
- In jurisdictions with incentive regulation arrangements, there should be an equal treatment of opex and capex to remove capex biases.
- Innovation is also important in promoting smart grids:
  - Most European regulatory regimes provide weak incentives for innovation, so some are providing significant R&D funding;
  - But SEE jurisdictions may prefer a "fast follower" model.
- Cost-reflective network pricing and procurement mechanisms for non-network technologies will all help third parties to provide network services.

14

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